

REMARKS

Applicants thank the Examiner for accepting the drawings filed on October 23, 2003.

Claims 1-4 and 7-32 are all the claims pending in the application. Claims 12-32 have been withdrawn from consideration as being directed to a non-elected invention.

Claims 1, 2, 7(1) and 7(2) have been rejected under 35 U.S.C. § 102(b) as allegedly anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as allegedly obvious over Shimada et al, U.S. Patent No. 5,662,972 ("Shimada").

Applicants traverse the rejection for the following reasons. Applicants' claimed invention relates to a method of preparing a laminate having a fluorine resin and a crosslinking elastic adhesive body directly bonded to each other, which imparts excellent bonding properties such as storage stability, a surface protecting property, stain resistance, a high transparency and a sealing property.

The improved bonding properties are achieved by treating the fluorine resin surface to increase the energy of the surface before lamination of the crosslinking elastic adhesive body thereto. Treatment of the surface is described in (1) to (3) described below.

(1) A method for the surface treatment of a fluorine resin wherein the surface of the resin has an absorbance at 360 nm of not smaller than $0.02/100\text{ cm}^2$ when measured by iodometry.

(2) A method for subjecting a fluorine resin surface to corona discharge treatment in an atmosphere of a nitrogen gas while controlling the concentration of an oxygen gas in the range of 4 to 150 ppm.

(3) A method for carrying out a thermal treatment after having subjected a fluorine resin surface to corona discharge treatment in air.

Shimada discloses a process for producing a tubular fluorine-containing resin laminate which comprises discharge-treating an outer surface of a tubular fluorine-containing resin molded article, extruding a molten resin onto the treated surface, and coating the treated surface with the molten resin. In addition, Shimada discloses the treatment of fluorine resin by corona discharge treatment in an inert gas atmosphere containing an organic compound having a functional group.

Applicants submit that the present invention is not anticipated by or obvious in view of Shimada since Shimada fails to disclose a surface-treating method of a fluorine resin, which comprises subjecting a fluorine resin to surface treatment so that an absorbance at 360 nm is $0.02/100 \text{ cm}^2$ or over when determined by iodometry and a method for making a laminate having the fluorine resin therein.

Additionally, Applicants submit that there is no disclosure, teaching or suggestion in Shimada that the absorbance measurement is related to the condition of the surface-treated fluorine resin. Shimada fails to disclose or teach employing the iodometric measurement, much less, the measurement used as an index indicating strong bond with a crosslinking elastic adhesive body upon crosslinkage. Furthermore, the specific absorbance value at the specific wavelength according to the invention is not disclosed in Shimada. Therefore, Applicants respectfully submit that the present invention is not anticipated by Shimada.

The Examiner alleges that it would have been obvious to one of ordinary skill in the art to provide a number of functional groups on the surface sufficient to create the strong adhesion which would directly result in the surface having the claimed absorbance at 360 nm. However, Applicants submit that Shimada fails to disclose or teach the use of iodometric measurement as an index to quantify acidic or reductive functional groups and radical-generating function groups such as diazo groups or peroxide groups on the surface of the fluorine resin. Shimada does not teach or suggest that such an index is useful to quantify the radical generating functional groups on the surface. When the surface-treated fluorine resin of Applicants' invention is immersed in the solution, I^- is oxidized into I^{3-} by means of radical generating functional groups including peroxide. Absorbance of the solution is measured at 360 nm, which helps to assess the quantity of radical-generating functional groups on the treated surface allowing a strong bond between the fluorine resin and a crosslinking elastic adhesive body. However, radical-generating function groups are not generated on the surface of the fluorine resin if it is treated by Shimada's method. Thus, it will result in almost zero absorbance at 360 nm when the fluorine resin of Shimada is measured by iodometry.

A person of ordinary skill in the art might have known that there required a number of functional groups on the surface sufficient to create the strong adhesive surface, nevertheless, those skilled in the art wouldn't have been motivated to refer to Shimada to use the iodometry as an index to obtain the optimum bonding condition as disclosed in Applicants' claimed invention.

As an index indicating strong bond between the fluorine resin and the crosslinking elastic adhesive body upon crosslinkage, Applicants have studied a peak of I^{3-} detected at 360 nm in an

iodometric method and found that it demonstrates the existence of the functional groups. As a consequence, Applicants have found that a fluorine resin, which is so treated that its absorbance at 360 nm is detected as a value of 0.02/100 cm² or over, is excellent in the bonding property as a whole.

Further, when the treated fluorine resin and a crosslinking elastic adhesive body such as an ethylene-vinyl acetate copolymer are directly laminated with each other and integrally combined together, the fluorine resin and the crosslinking elastic adhesive body are bonded strongly, thereby making it possible to reliably make a laminate with excellent bonding properties such as storage stability, a surface protecting property, stain resistance, a high transparency and a member-sealing property. Though conditions of the treatment such as the intensity and duration vary and even the fluorine resins have different quantities of energy density, in so far as the absorbance at 360 nm is 0.02/100 cm² or over, desired bonding force can be obtained, leading to the laminate in which the fluorine resin and the crosslinking elastic adhesive are strongly bonded to each other as proved in Examples 1, 2 and Comparative Example 1. Original Examples 1 and 2 demonstrated almost the same high bonding force regardless of the difference of energy density.

Applicants submit that Shimada does not teach or suggest the lamination where the surface treated fluorine resin is bonded to a crosslinking elastic adhesive body composition such as a thermal and/or photocurable crosslinking elastic adhesive body composition formulated with an organic peroxide and/or a photosensitizer. Moreover, Applicants submit that Shimada is directed merely to producing a fluorine-containing resin having minimized surface tension in

which a coating layer having a lower melting temperature than that of the inner resin and a surface tension of not less than 30 dyn/cm is coated to the fluorine-containing resin without crosslinking and being integrally formed as described in Applicants' claimed invention.

As previously discussed, it is important to introduce radical generating functional groups to the surface of the fluorine resin so that the laminate having a satisfactory bonding to the crosslinking elastic adhesive body can be obtained since the elastic adhesive body is crosslinked by means of a radical initiator. Shimada fails to disclose this feature. To achieve the laminate having this excellent property, iodometric measurement is effectively employed to determine the quantity of radical generating functional groups on the fluorine resin surface. If the absorbance is less than $0.02/100 \text{ cm}^2$, then the amount of the radical generating functional groups is too small to impart satisfactory bonding to a crosslinking elastic adhesive body, failing to ensure direct and strong bonding to a crosslinking elastic adhesive body.

Accordingly, Applicants respectfully submit that the inventive method of treating a surface of a fluorine resin so that an absorbance at 360 nm is $0.02/100 \text{ cm}^2$ or over when determined by iodometry and the feature thereof are not obvious over Shimada.

Claims 1, 2, 7(1), 7(2), 8 and 11 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over the "admitted" prior art (specification pages 1 and 2).

The Examiner alleges that it would have been obvious to one of ordinary skill in the art to provide a number of functional groups on the surface sufficient to create the strong adhesion which would directly result in the surface having the claimed absorbance at 360 nm. However, Applicants submit that the "admitted" prior art fails to disclose or suggest Applicants' claimed

invention. In Applicants' specification, it is described as follows: "the corona treatment is able to produce, on the fluorine resin surface, various types of functional groups that contribute to imparting good bonding properties thereto and is thus known as an effective treating method." (see Applicants' specification, page 2, lines 3-7). However, the fluorine resin surface treated by these treating methods may be unsatisfactory, in some cases, with respect to its bonding force, thus the best use being not made of the surface-treating effect at present."

Applicants submit that there is no disclosure of the use of the iodometric method as an index indicating the quantity of radical-generating functional groups, or indicating strong bond with a crosslinking elastic adhesive body upon crosslinkage in the prior art. Applicants also submit that the "admitted" prior art fails to disclose, teach, or suggest a surface treatment of the fluorine resin with corona discharge in a nitrogen gas atmosphere with an oxygen gas of 4 to 150 ppm, or with corona discharge in air and subsequently thermally treated, followed by a lamination of a crosslinking elastic adhesive body. Further, the "admitted" prior art does not teach or suggest that the lamination having a satisfactory storage stability is achieved by the methods according to Applicants' claimed invention. Therefore, Applicants respectfully submit that the present invention is not obvious over the "admitted" prior art.

Claims 3, 4, 7(3) and 7(4) have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Shimada et al. ("Shimada") in view of Kreil et al, U.S. Patent No. 4,594,262 ("Kreil"). In addition, claims 3, 4, 7(3), 7(4), 8 and 11 have also been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over the "admitted" prior art in view of Shimada et al. ("Shimada") and Kreil et al ("Kreil").

Kreil discloses a method of treating a polyester film base by subjecting to an electron beam irradiation and applying organic coatings thereto. Additionally, Kreil discloses that "By "inert atmosphere" is meant an environment comprising flue gas, nitrogen, or a gas of Group O of the Periodic Table and containing no more oxygen than 100 parts per million." However, Kreil discusses in the background of the invention that "Because of its low cost, a leading treatment is corona discharge even though it is only partially effective. Furthermore, because corona discharge treatment is transitory, any coating must be promptly applied to the treated polyester film base....Where better adhesion is demanded, the polyester film base may be chemically treated, such as with para-chlorophenol...." Thus, Applicants' submit that Kreil teaches away from using corona discharge treatment to enhance the properties of the surface. Moreover, Applicants also submit that Kreil fails to disclose or teach the surface treatment of the fluorine resin.

The method of Kreil involves the irradiation of the electron beam and has nothing to do with the method according Applicants' invention. Though Kreil mentions the atmosphere containing a certain amount of oxygen gas, Kreil does not teach or suggest the specific amount of the oxygen gas as required in Applicants' claimed method. Since Kreil is directed to the treatment of the polyester film by the electron beam irradiation, and Shimada and the "admitted" prior art are concerned with the surface treatment of the fluorine resin, Applicants respectfully submit that one of ordinary skill in the art at the time the invention was made would not have been motivated to combine these references.

Furthermore, Applicants also submit that Kreil fails to disclose or teach the surface treatment of the fluorine resin with corona discharge and the method of making the lamination thereof, as well as the advantageous bonding property and excellent storage stability. Likewise, Shimada is only concerned with the corona discharge treatment in an inert gas atmosphere containing an organic compound having a functional group, and does not relate to the treatment in an inert atmosphere with the specific amount of oxygen content. Further Shimada and the “admitted” prior art fail to teach or suggest the storage stability of the lamination, therefore, Applicants respectfully submit that the combination of these references would not have given one of ordinary skill in the art Applicants’ claimed inventive method and the feature thereof.

As previously discussed, the surface treatment in an atmosphere of nitrogen with 4 to 150 ppm oxygen produces a laminate in which the fluorine resin and crosslinking elastic adhesive are strongly bonded together with superior storage stability, minimizing the deterioration in the bonding force after storage for one month. Original Examples 3 to 7 and Comparative Examples 2 to 4 show that acceptable storage stabilities of 80% or above were observed for oxygen gas concentrations in the range 4 to 150 ppm (page 28, table 2). A departure from this range (from 134 to 460 ppm) resulted in a relatively large drop (12 percentage points) in the storage stability of the laminate (Original Example 7 and Comparative Example 3). Moreover, when the oxygen gas concentration exceeds the optimum range (Comparative Example 4), an initial bonding force considerably lowers and the bonding force after one month and storage stability could not be evaluated and the laminate obtained was completely useless.

As described above, controlling the concentration of an oxygen gas at the optimum range of 4 to 150 ppm in the nitrogen gas is important when subjecting corona discharge treatment to the fluorine resin in order to achieve the drastically improved bonding property between the fluorine resin and the crosslinking elastic adhesive body and storage stability of the laminate.

The Examiner alleges that it is readily understood in the art that an inert atmosphere does not require 0 ppm and the conventional inert atmospheres would include more than 4 ppm of oxygen. The Examiner further alleges that the difference between the results for 2 ppm and 4 ppm of the invention are not clear.

First, Kreil, as stated above, teaches away from Applicants' claimed invention and the other references are not concerned with studying the concentration of oxygen gas in the atmosphere. Applicants submit that one of ordinary skill in the art may have appreciated that the inert gas atmosphere would contain a trace amount of oxygen such as 100 ppm or less, however, the references do not teach nor suggest the specific amount of oxygen concentration as clearly indicated in Applicants' claimed invention or the measurement by a galvanic cell type densitometer.

In addition, Applicants' submit that the results for 2 ppm and 4 ppm are not unclear because even a departure from the optimum range led to a large drop in the storage stability of the laminate (Comparative Example 2 and Original Example 3). Applicants' results in the inventive range never failed to achieve constantly high storage stability of more than 80%, whereas the results out of the inventive range achieved only more or less of 70% and never 80% or above. The Examples clearly demonstrate this characteristic feature of Applicants' claimed

invention. Therefore, Applicants respectfully traverse the Examiner's assertion that it is unclear whether additional effort is required to reduce the inert atmosphere to 2 ppm and 4 ppm.

Accordingly, Applicants respectfully submit that the surface treatment of a fluorine resin, which comprises subjecting the surface of a fluorine resin to corona discharge treatment in a nitrogen gas atmosphere while controlling a concentration of an oxygen gas within a range of 4 to 150 ppm, and a method for making a laminate having the fluorine resin therein would not have been obvious over Shimada in view of Kreil or over the "admitted" prior art in view of Shimada and Kreil.

Claim 9 has been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over the "admitted" prior art and further in view of Krause et al., U.S. Patent No. 5,958,532 ("Krause"). Claim 9 has also been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over the "admitted" prior art, Shimada et al. ("Shimada") and Kreil et al. ("Kreil"), and further in view of Krause et al. ("Krause").

Krause discloses a method of preparing a fluoropolymer composite tube comprising the steps of forming a fluoropolymer substrate, and thereafter layering and chemically bonding the fluoropolymer with a thermosetting or thermoplastic elastomer. The fluoropolymer such as ethylene-tetrafluoroethylene (ETFE) is extruded by a melt extrusion on which thermosetting or thermoplastic elastomer material is bonded and then crosslinking and adhesion occur. The surface of fluoropolymer is treated prior to extruding the elastomer by plasma discharge or corona discharge.

Applicants submit that Krause may teach the crosslinking, however, Krause uses the amine curing agents such as triethylene tetramine along with the thermosetting materials. On the contrary, Applicants' claimed invention does not use amine curing agents but uses organic peroxide for thermal curing and/or radical photopolymerization initiator for photopolymerization together with ethylene-vinyl acetate copolymer. Thus, the laminate comprising fluorine resin and ethylene-vinyl acetate copolymer according to Applicants' claimed invention has excellent storage stability as well as improved bonding force. Therefore, Applicants respectfully submit that Krause fails to disclose or teach Applicants' inventive method and the feature thereof and thus Applicants' claimed invention is not obvious over the "admitted" art in view of Krause, or over Shimada, the "admitted" prior art and Kreil further in view of Krause.

Claim 10 has been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over the admitted prior art and further in view of Kataoka et al., U.S. Patent. No. 6,307,145, ("Kataoka"). Claim 10 has also been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over the "admitted" prior art, Shimada et al. ("Shimada") and Kreil et al. ("Kreil"), and further in view of Kataoka et al. ("Kataoka").

Kataoka relates to a solar cell module in which a light incidence side surface of a photovoltaic element is sealed by a covering member comprised of at least two layers including a sealant resin layer of a transparent, organic polymer resin and an outermost transparent surface protecting film. In addition, Kataoka teaches that the transparent surface sealant resin layer contains a crosslinked resin such as ethylene-vinyl acetate copolymer resin crosslinked by an organic peroxide. Though Kataoka may teach crosslinking EVA using a radical initiator,

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Applicants submit that Kataoka is directed to the solar cell module having the surface film with the specific oxygen permeability, and is not directed to a surface treating method of a fluorine resin as disclosed in Applicants' claimed invention or the method of laminating the crosslinking elastic adhesive body thereto. Therefore, Applicants respectfully submit that one of ordinary skill in the art would not have been motivated by Kataoka to arrive at Applicants' claimed invention.

In addition, Applicants submit that since Kreil and Kataoka fail to teach or suggest the surface treatment of the fluorine resin followed by bonding the crosslinking elastic adhesive body to form the lamination, there is no reasonable motivation to combine Shimada, Kreil, the "admitted" prior art and Kataoka. Therefore, Applicants respectfully submit that the claimed invention and the feature thereof would not have been obvious to one of ordinary skill in the art in view of Shimada, Kreil, the "admitted" prior art, and Kataoka.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned attorney at the telephone number listed below.

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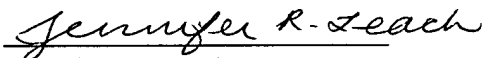
Respectfully submitted,

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE

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CUSTOMER NUMBER


Jennifer R. Leach
Registration No. 54,257

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